

ABSCESS OF THE CRYSTALLINE LENS

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Perforating injuries of the globe frequently involve the lens by causing perforation of the anterior capsule and the production of varying stages of traumatic cataract. If infection accompanies the perforation, a purulent infiltration results in abscess of the lens. Such diagnoses are usually made by pathologic section following enucleation of the infected or shrunken eye. It seems of interest, therefore, to report a case of intra-ocular infection in which abscess of the crystalline lens dominated the ocular findings, and in which healing occurred with seclusion of the pupil.

In Posey and Wright's textbook, "Diseases of the Eye, Ear, Nose and Throat" (1903), there is a single reference to purulent infiltration of the lens following iridocyclitis produced by a perforating injury of the ciliary body. An illustration of the pathologic section of the eye accompanies the reference.

Abscess of the lens is not considered under the heading of "Diseases of the Lens" in the modern textbooks of Fuchs, Berens, or Duke-Elder, nor is it mentioned in Würdemann's textbook on "Injuries of the Eye."

In a recent article on "Lesions in the Lens from Corneal Ulcers" Samuels found only one case in a large series of eyes enucleated for corneal ulcer with hypopyon, in which there were pus-cells within the lens capsule. In this case he could not be sure that the thin posterior capsule was intact, and asserted his continued belief in the active impermeability of the lens capsule to cells.

Jonas Friedenwald states that "the relation of the lens to intra-ocular infections is entirely a passive one. It is an excellent culture-medium, and bacteria introduced into its interior grow most luxuriantly. Injuries which involve perforation or rupture of the lens capsule are, therefore, most likely to result in severe infections, for the organisms once in the lens are able to multiply at a rapid rate before they can be reached by pus cells."

Sullivan has commented on the work of Morax and Chiazzaro, who, in enucleating seven eyes following perforating injuries of the lens in which panophthalmitis had ensued, conducted bacteriologic studies in which material obtained directly from the lenses was cultured. In six out of seven cases the micro-organism which was the infectious agent in the lens belonged to a group of spore-forming bacilli which have their habitat in the ground and are generally considered as only slightly pathogenic or non-pathogenic. In three cases the infecting organisms were bacilli having the characteristics of *Bacillus subtilis*. Two cases demonstrated filamentous, gram-positive bacilli showing terminal spores. One case showed a gram-negative bacillus which presented endospores. In one case these observers found a gram-positive, filamentous bacillus which was not spore bearing.

These studies led Morax and Chiazzaro to consider the possibility that the lens tissue might represent a particularly favorable field for the growth of spore-bearing organisms. Accordingly they applied this hypothesis to experimental studies on the eyes of rabbits by injecting cultures of various spore-bearing micro-organisms directly into the lens. Spores injected into the anterior chamber disappeared quickly and caused only slight changes. Spores injected into the lens multiplied rapidly and in considerable numbers, and gave rise to severe inflammatory reactions. In the lens, the micro-organisms are protected by the barriers of lens capsule and cortex and the leukocytes of the aqueous cannot reach them. Pneumococci and staphylococci grew well in the lens sub-

stance and produced infections of the lens with subsequent panophthalmitis.

Under these conditions micro-organisms which ordinarily are of low vitality or are non-pathogenic in character may undergo characteristics and destroy a globe since the lens cortex acts as an excellent culture-medium. This may well explain some of the late post-operative cataract infections in which lens material left in the pupillary space incarcerates micro-organisms from which, after a prolonged incubation period, infections develop.

Although lens injuries are common in perforating and non-perforating wounds of the globe, infection of the lens was found in but eight of our series of 73 eyes removed for various reasons following perforating injuries. These eyes were all fixed, sectioned, and examined at the Army Medical Museum, and demonstrated varying degrees of involvement of the lens and globe. The progress of purulent infiltration depends on such factors as the extent of the lens trauma, the virulence of the infecting organisms, the length of time that elapses between the injury and enucleation and the post-traumatic treatment.

In current literature references to abscess of the crystalline lens are very rare. Yver and Barrat reported a case of intra-ocular infection in which abscess of the lens followed a perforating injury sustained while the patient was chopping wood. On the sixteenth day there was violent pain in the eye and orbit; corneal clouding and hypopyon were present, and a tiny yellow spot was observed on the anterior lens surface. Paracentesis was done, and culture of the material yielded a growth of staphylococci. The globe was enucleated after twenty-four hours, and the microscopic section showed the lens capsule to be filled with purulent material.

A. Bussaca has reported what is apparently the first recorded case of abscess of the crystalline lens in which the globe was saved. A young girl was struck in the eye by a penpoint which penetrated the cornea and lens, and was

followed by purulent infiltration of the lens. The lens material contained pneumococci, but the eye recovered with seclusion of the pupil. In eight rabbits Bussaca punctured the lens through the cornea, using different micro-organisms to produce infections. His conclusions were: Infection of the lens is possible only if the anterior or posterior capsule is perforated. Rapid closure of a small puncture wound in the capsule may occur and thus prevent the entrance of germs from the aqueous or may retard their rapid multiplication if they have already gained entrance. Simultaneous injury of the iris causes the infection to run a severe course complicated by iridocyclitis. He found his most severe infections produced by pneumococci, the least severe by gonococci.

Hertel, in an article on "The Operative Closure of the Wound in Perforating Injuries of the Cornea," demonstrated by microphotograph the pathologic section of an eye containing an abscess of the crystalline lens which followed a perforating injury. As this case illustrates by microscopic section the condition existing in our patient on the occasion of his first visit to our office, we have included it here (fig. 1).

Before the era of chemotherapy practically all eyes suffering from perforating injuries accompanied by infection were lost. It seems worth while, therefore, to record the second case in which the globe was apparently saved after primary abscess formation in the lens followed penetration of the cornea and lens by a metallic foreign body which was successfully extracted by magnet.

CASE REPORT

Mr. J. E. DeL., aged twenty-seven years, while hammering on a steel file on April 2, 1941, felt something strike the left eye. Five days later he reported for examination to Dr. R. J. Calcote, Little Rock, Arkansas, who provided the following notes: "At that time the pupil dilated evenly and widely and a small scar could be seen near the center of the cornea, with a scar on the lens capsule immediately behind it; also a small piece of steel could easily be seen near the center of the lens, and this was extracted through a kera-

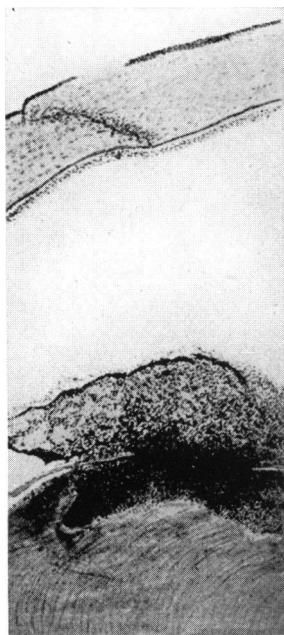


Fig. 1.—Microscopic section of penetrating wound of the cornea with abscess in the crystalline lens (E. Hertel).

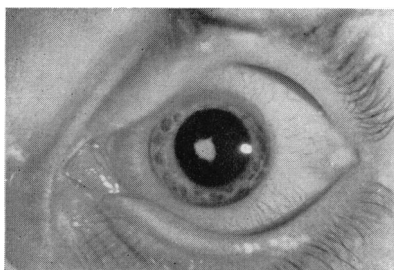


Fig. 2.—Primary abscess of the crystalline lens five weeks after penetrating injury.

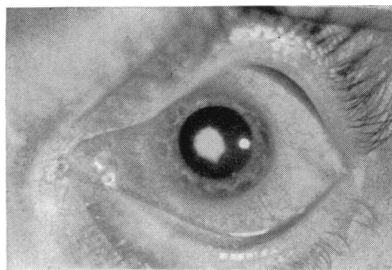


Fig. 3.—Increased infiltration of the lens eleven days later.



Fig. 4.—Abscess of the lens with hypopyon two months after original injury.

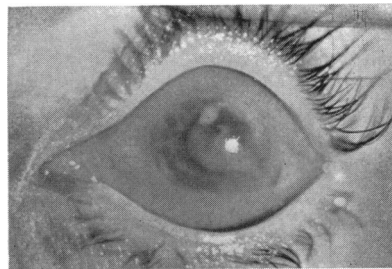


Fig. 5.—Abscess of the lens with hypopyon during the period of daily paracenteses.

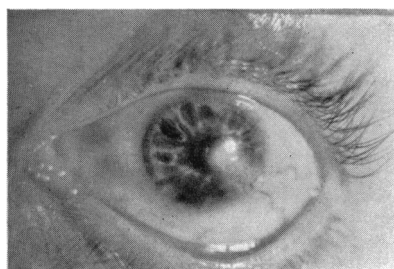


Fig. 6.—End stage of abscess of the lens. Corneal opacity following trauma to the endothelium, clearing of the anterior chamber, seclusion of the pupil, and secondary glaucoma.

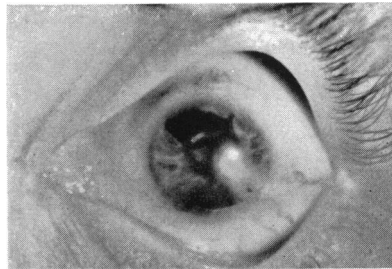


Fig. 7.—Iridectomy for secondary glaucoma following abscess of the lens.

tome incision by the hand magnet. I saw him two weeks later, at which time he had not used atropine for three days and had a very definite iritis. Atropine was again prescribed, and I saw him again three weeks later, with the iritis very definitely improved, but still with considerable inflammatory reaction."

On May 12 the patient reported to our office. There was moderate ciliary injection, although the pupil was widely dilated. A central perforating scar in the central cornea, 1 mm. wide in its vertical diameter, was visible. The aqueous was turbid. There was a yellowish area in the anterior lens substance which resembled a purulent focus rather than an opaque change in the character of the lens cortex. The lens was clear peripherally and the fundus seemed to be normal. The tension to fingers was normal (fig. 2).

The patient was immediately admitted to the Memphis Eye, Ear, Nose and Throat Hospital, given 30 million typhoid H antigen intravenously, with atropine and heat locally, and $1\frac{1}{2}$ grains of calomel, followed by a saline purge, internally. The following morning the temperature was 99.5° F. and sulfathiazole was administered, 4 grams being given as the initial dose and one gram every six hours thereafter.

Increasing doses of foreign protein in the form of typhoid H antigen in the amount of 50 million, 75 million, and 100 million were given on May 15, 18, and 21, respectively. Febrile reactions to temperatures of 100°, 101°, and 100° F. were noted. There was a distinct increase in the lens infiltration, with a clumping of cells in the anterior chamber. It was difficult to keep the pupil dilated, and 2 per cent. ointments of atropine and epinephrine bitartrate were employed.

On May 19 sulfathiazole concentration of the blood was 8.1 mg. per cent. The hemoglobin, blood-cell counts, and blood-smear examinations were normal.

On May 23 the eye showed improvement, and the patient desired to return to his home, about 200 miles away. His chemotherapy was changed to sulfanilamide, and on May 25 the blood concentration for this drug was 4.3 mg. per cent. On May 26 he was allowed to go home, and sulfanilamide, 10 grains 4 times a day, with atropine ointment, 2 per cent., and epinephrine bitartrate jelly, 1 per cent., to be used alternately in the eye (fig. 3), were prescribed.

On June 5 he returned, stating that the eye had been comfortable during the interim, but that the vision was reduced to moving objects. There was definite increase in the lens opacity with hypopyon (fig. 4).

He was readmitted to the hospital and more foreign protein was given, with temperature reaction to 100.5° F. As the hypopyon increased, paracentesis by subconjunctival keratome incision at 9 o'clock was done on June 7. Material was obtained from the aqueous and cultured on brain broth as a preliminary medium, and subcultured on a modified Löffler's medium—agar with dextrose added. On June 9 there was a pure growth of *Staphylococcus aureus*. The paracentesis wound was reopened daily thereafter, and sulfathiazole in adequate dosage was again administered. Daily paracenteses were done throughout the period from June 7 to June 15, when the eye began to show evidence of clearing. On June 11 material from the aqueous was again cultured, but there was no growth on the media (fig. 5).

On June 20 the sulfathiazole concentration of the blood was 5.1 mg. per cent. On June 21 there was ciliary injection. The cornea showed a number of deep vessels around the limbus. The anterior chamber was of unusual depth, and one half of it was occupied by a yellowish mass which overlay the pupil. There was light perception with good projection. Tension to fingers was minus. The patient was sent home, and sulfathiazole, 0.5 gm. three times a day, and atropine ointment, 1 per cent. locally, were ordered.

On July 8 the pupil was filled with a vascularized yellow mass and there was vascularized matter laterally in the anterior chamber.

On July 23, when the patient returned, there was definite clearing of the globe, although the pupil was constricted and posterior synechiae were evident. The cornea showed some opacities, with superficial and deep vessels. There appeared to be organized material in the anterior chamber, which seemed to be continuous with the lens opacity. From this mass vessels passed on to the iris. Tension to fingers was questionable. Treatment was discontinued.

By November 10 the eye had become quite white. However, the patient complained of almost daily headache, coming on late in the afternoon; the tension (Schiötz) in this eye was 40 (fig. 6). Pilocarpine solution, 1 per cent., three times a day, was prescribed.

On January 13, 1942, tension was 48, and operation was advised. On February 13 a corneoscleral trephining on the left eye was done, but a modified form of anterior sclerectomy was employed because the chamber angle above was obstructed by scar tissue and the iris failed to prolapse. Convalescence was uneventful, and on March 7 the tension was 26 (Schiötz). There was a broad iridectomy, which disclosed deposits of cholesterol under the lens capsule. Medication was discontinued, but finger massage twice daily was instituted. Light projection was normal (fig. 7).

Subsequent observation disclosed a quiet, clear globe and a tendency toward return of hypertension, which was controlled by miotics. The final outcome is doubtful, but at present there is no discomfort.

SUMMARY

1. A case of abscess of the lens treated by chemotherapy and paracentesis, followed by alleviation of the infection and retention of the globe to date, is reported.

2. Early culture of the aqueous or lens substance by hypodermic needle paracentesis in infections of the anterior segment may aid in determining the type of medication to employ.

3. Chemotherapy in conjunction with fever therapy is suggested as the first step in the medical treatment of all perforating injuries.

4. Repeated paracenteses are of value in abscess of the anterior segment of the globe; they probably induce a higher concentration of the chemotherapeutic agent in the aqueous, in addition to an increased titer of specific antibodies.

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DISCUSSION

DR. FRANCIS HEED ADLER, Philadelphia, Pa.: The ordinary crystalline preparation of sulfa drugs cannot be injected with a hypodermic needle as the crystals are too large. Dr. B. F. Souders, in my department, conceived the idea that these crystals might be broken up by sonic vibration, and one of the research chemists in the Johnson Foundation succeeded in doing this and in producing a microcrystalline form of the drug. The importance of this was immediately recognized by the whole surgical division of the hospital, and the Smith Kline French Laboratories made a grant to the

hospital for the study of these preparations. A report on the crystalline form of the drugs has already been made in the Journal of the American Medical Association in a paper by Chambers, Harris, Schumann, and Ferguson. We have used the microcrystalline form in experimental intra-ocular injections and believe that it is of value. Some of the histologic sections, however, show changes in the retina, which we believe may be due to the drug itself, and accordingly we are not advising the intra-ocular injection of the microcrystalline form at the present time. In desperate cases, such as those just reported, this form of the drug might be of some use.

At present the chief usefulness of the microcrystalline form in ophthalmology seems to be the employment of the preparation in a lacrimal syringe for getting sulfa compounds into the lacrimal sac.

DR. WILLIAM CRISP, Denver, Colo.: I am not clear as to the use of the crystals. Are the crystals in solution?

DR. ADLER: In suspension. The crystals are small enough to go through the needle.

CATARACT COMPLICATING CORNEAL SCARS AFTER PERFORATING ULCERS

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We live at a time that will be memorable in the history of ophthalmology, namely, the epoch of the invention of the slit-lamp. However, this method of examining *in vivo* many different parts of the eye is not without its limitations. If one would learn how a lens fares under an opaque cornea, he must have recourse to the older method of studying microscopic preparations. Not since the days of Wedl¹ and Becker,² and later of Treacher Collins,³ has any important study of the microscopic pathology of the lens been made. The times require a descriptive and illustrated review of the subject, in order to render more readily available the findings of the older workers scattered throughout the literature, and, if possible, to add new points.